



US009638478B2

(12) **United States Patent**
Byman

(10) **Patent No.:** **US 9,638,478 B2**
(45) **Date of Patent:** **May 2, 2017**

(54) **HEAT EXCHANGER FOR COOLING BULK SOLIDS**

(71) Applicant: **SOLEX THERMAL SCIENCE INC.**,
Calgary (CA)

(72) Inventor: **Ashley Dean Byman**, De Winton (CA)

(73) Assignee: **SOLEX THERMAL SCIENCE INC.**,
Calgary (CA)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 377 days.

(21) Appl. No.: **14/341,440**

(22) Filed: **Jul. 25, 2014**

(65) **Prior Publication Data**

US 2016/0025417 A1 Jan. 28, 2016

(51) **Int. Cl.**

F28F 3/14 (2006.01)

F28F 9/02 (2006.01)

F28D 7/08 (2006.01)

F28D 21/00 (2006.01)

(52) **U.S. Cl.**

CPC **F28F 3/14** (2013.01); **F28D 7/082**
(2013.01); **F28F 9/0246** (2013.01); **F28D**
2021/0045 (2013.01); **F28F 2230/00** (2013.01)

(58) **Field of Classification Search**

CPC C10J 3/52; F26B 17/126; F26B 17/16; F28D
7/0066; F28D 7/087; F28D 7/1615; F28D
7/1623; F28D 9/00; F28D 9/006; F28D
9/0093; F28D 9/0031; F28D 2021/0045;
F28D 7/082; F28F 1/045; F28F 3/14;
F28F 9/0246; F28F 2230/00

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,276,496 A * 3/1942 Kennedy F27D 15/0286
34/170
2,911,198 A * 11/1959 Karlsson F28C 3/14
165/111
3,872,606 A * 3/1975 Kashul B65G 69/20
34/166
4,014,642 A * 3/1977 Helming B02C 4/02
241/66
5,167,274 A * 12/1992 Mueller B01J 2/04
165/170
5,727,689 A * 3/1998 Anderson B02B 1/08
209/139.1
6,328,099 B1 * 12/2001 Hilt C05G 3/0058
165/166

(Continued)

Primary Examiner — Tho V Duong

(74) *Attorney, Agent, or Firm* — Borden Ladner Gervais
LLP; Geoffrey deKleine

(57)

ABSTRACT

A heat exchanger comprises a housing that includes an inlet for receiving bulk solids having a first temperature, and an outlet for discharging the bulk solids. A plurality of spaced apart, substantially parallel heat transfer tubes are disposed within the housing between the inlet and the outlet, for cooling the bulk solids that flow from the inlet into spaces between heat transfer tubes, to a second intermediate temperature, and a plurality of spaced apart, substantially parallel heat transfer plate assemblies disposed within the housing and interposed between the plurality of heat transfer tubes and the outlet for further cooling the bulk solids that flow from the spaces between heat transfer tubes, to spaces between heat transfer plate assemblies and to the outlet, to a third temperature.

18 Claims, 10 Drawing Sheets

